



North Carolina Department of Environment and Natural Resources

Pat McCrory  
Governor

John E. Skvarla, III  
Secretary

February 26, 2014

Howard Shelanski  
Administrator  
Office of Information and Regulatory Affairs  
Office of Management and Budget  
725 17th Street, NW  
Washington, DC 20503

RE: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866

Dear Mr. Shelanski:

North Carolina submits these comments to the Office of Management and Budget's November 26, 2013 notice requesting comments on the Technical Support Document (TSD) entitled *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*.<sup>1</sup> Although the Office of Management and Budget (OMB) has taken a first step toward correcting errors of law and national policies, it must correct remaining errors with the following steps:

- Subject its SCC valuation to independent, external peer review to comply with OMB's requirements under the Information Quality Act (IQA) and OMB's own peer review bulletin; and,
- If OMB intends to keep the framework in the draft SCC and not change it to be consistent with OMB Circular A-4, then OMB should change all of the provisions of Circular A-4 and other OMB Circulars to be consistent with the SCC TSD. By substantially changing the scope of regulatory analysis for one potential externality, the SCC TSD by itself is a fundamental distortion of Circular A-4 requirements.
- OMB must reconcile its role as either being an advocate for systematic bias in overstating regulatory benefits or reestablish itself as a neutral arbiter for best practices in benefit-cost analysis. For example, OMB has not provided guidance to agencies that the SCC should be included when estimating the social costs of regulation. As OMB's guidance currently stands, agencies must use a global value for carbon emission benefits (but not other benefits), though not for social costs.

Moreover, numerous federal actions affect the direct or indirect carbon dioxide emission across the globe. OMB has not explained why it is singling out regulatory actions for special treatment as opposed to other Federal actions such as grants, infrastructure spending, and loans.

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<sup>1</sup> 78 FR 70586.

## *Specific Concerns*

The Technical Support Document (TSD) raises questions concerning the validity of the models and data used in developing the projected costs. As one economist warned, future damage impacts, GDP, and discount rates in the models tend to be arbitrary and slight variations in these inputs may dramatically affect the SCC estimate projections. For example, a decrease in the discount rate from 5% to 2.5% for the year 2020 more than quadruples the SCC in the model.<sup>2</sup> As cited by another economist, Dr. Robert Pindyck with the National Bureau of Economic Research:

*“These models have crucial flaws that make them close to useless as tools for policy analysis: certain inputs (e.g. the discount rate) are arbitrary, but have huge effects on the SCC estimates the models produce; the models' descriptions of the impact of climate change are completely ad hoc, with no theoretical or empirical foundation; and the models can tell us nothing about the most important driver of the SCC, the possibility of a catastrophic climate outcome.”*<sup>3</sup>

Given the sensitivity of model inputs and the uncertainty associated with each of the long term projections, we are perplexed as to why the critical elements of the OMB guidance in Circular A-4<sup>4</sup> for preparing benefit and cost estimates required by Executive Order 12866 and the "Regulatory Right-to-Know Act," were not followed. The guidance calls for regulatory agencies to:

1. Assess costs, benefits, and transfers at both the 3% and 7% discount rate;<sup>5</sup>
2. Clearly present the basic assumptions, methods, and data underlying the analysis;
3. Focus on benefits and costs that accrue to citizens and residents of the United States;
4. Present a formal quantitative analysis of the relevant uncertainties about benefits and costs; and
5. Consider private-sector compliance costs and savings;

### **7% Discount Rate**

The 2013 Working Group modeled the SCC at only the 2.5%, 3%, and 5% discount rates and neglected the most relevant discount rate of 7%. For the base case, Circular A-4 refers to Circular A-94 highlighting the relevance of applying the 7% discount rate.

*“As a default position, OMB Circular A-94 states that a real discount rate of 7 percent should be used as a base-case for regulatory analysis. The 7 percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It is a broad measure that reflects the returns to real estate and small business capital as well as corporate capital. It approximates the*

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<sup>2</sup> Written Testimony of Robert P. Murphy before the Senate Committee on Environment and Public Works on the Matter of “The Social Cost of Carbon; Some Surprising Facts” July 18, 2013

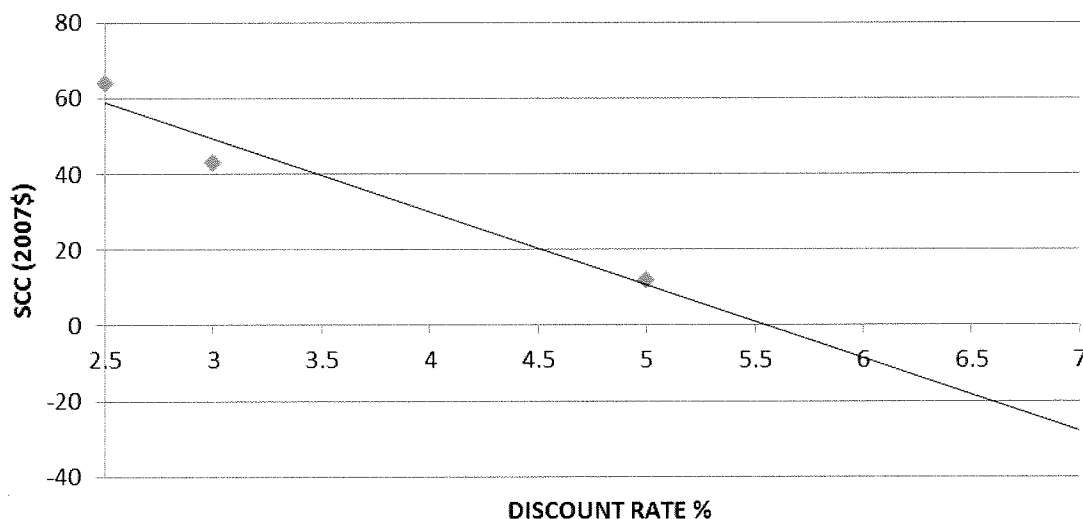
<sup>3</sup> Pindyck, R., Climate Change Policy, What Do the Models Tell Us, *Journal of Economic Literature* 51(3), 860-872, September 2013

<sup>4</sup> Circular A-4, Regulatory Impact Analysis: Frequently Asked Questions (FAQS); Office of Information and Regulatory Affairs. February 7, 2011; [http://www.whitehouse.gov/sites/default/files/omb/assets/OMB/circulars/a004/a-4\\_FAQ.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf)

<sup>5</sup> OMB's basic guidance on the discount rate is provided in OMB Circular A-94 (<http://www.whitehouse.gov/omb/circulars/index.html>).

*opportunity cost of capital, and it is the appropriate discount rate whenever the main effect of a regulation is to displace or alter the use of capital in the private sector. OMB revised Circular A-94 in 1992 after extensive internal review and public comment. In a recent analysis, OMB found that the average rate of return to capital remains near the 7 percent rate estimated in 1992. Circular A-94 also recommends using other discount rates to show the sensitivity of the estimates to the discount rate assumption.”*

The four updated SCC estimates for 2020 are \$12, \$43, \$64, and \$128 (2007\$). The first three values are the average SCC from three integrated assessment models at discount rates of 5, 3, and 2.5 percent and the fourth value is the 95th percentile SCC estimate across all three models at a 3 percent discount rate. In the absence of sufficient documentation that would allow calculation of the SCC at 7% using any of the models discussed, a value can be estimated through simple extrapolation using a linear regression of the first three points. The estimate is shown in the figure below and indicates that the sign of the SCC is apt to be negative at the 7% discount rate. A negative SCC indicates that the beneficial aspects of carbon dioxide emissions actually outweigh the costs.



### **Lack of Transparency**

The TSD specifies that DICE 2010, FUND 3.8, and PAGE09 were the three integrated assessment models used to establish the SCC. An attempt was made to review each of these models. No information was available for the DICE 2010 model on the homepage of William Nordhaus as promised in the TSD. When accessed on February 4, 2014 his homepage included only the DICE 2013R and RICE 2010 models. The DICE2013R user’s manual stated, “The prior complete documented version of the DICE model is Nordhaus (2008).” It is astounding that the 2013 Working Group would choose to use a SCC assessment model that lacked full documentation. Similarly, the TSD reference for the FUND model did not include version 3.8. The TSD provided no link to the PAGE09 model due to “structural changes including the addition of sea level rise and treatment of discontinuity.” Furthermore, we could locate no information for previous PAGE models. Without having an opportunity to review even one of the actual models, States can only understand in the broadest sense what factors influence the SCC and what has changed to cause such a dramatic increase the costs. We are left to guess input parameters such as the emissions rates, socioeconomic scenarios, and climate sensitivity and have no way to validate model functions. This validation is important as indicated by the following statement by the DICE developers:

*“They are prone to errors in the software and structure, data and scientific views evolve, and users must be attentive to the potential for large and small changes in the economics and natural sciences. Problems arise particularly when modifications are made to models (such as alternative parameterizations) and the model is not carefully tested to make sure that the changes do not alter the behavior or introduce instabilities. The DICE model has evolved significantly over the years since its development. The vast changes in the projections of different variables might lead some to conclude that these undermine the credibility of the modeling approach.”*

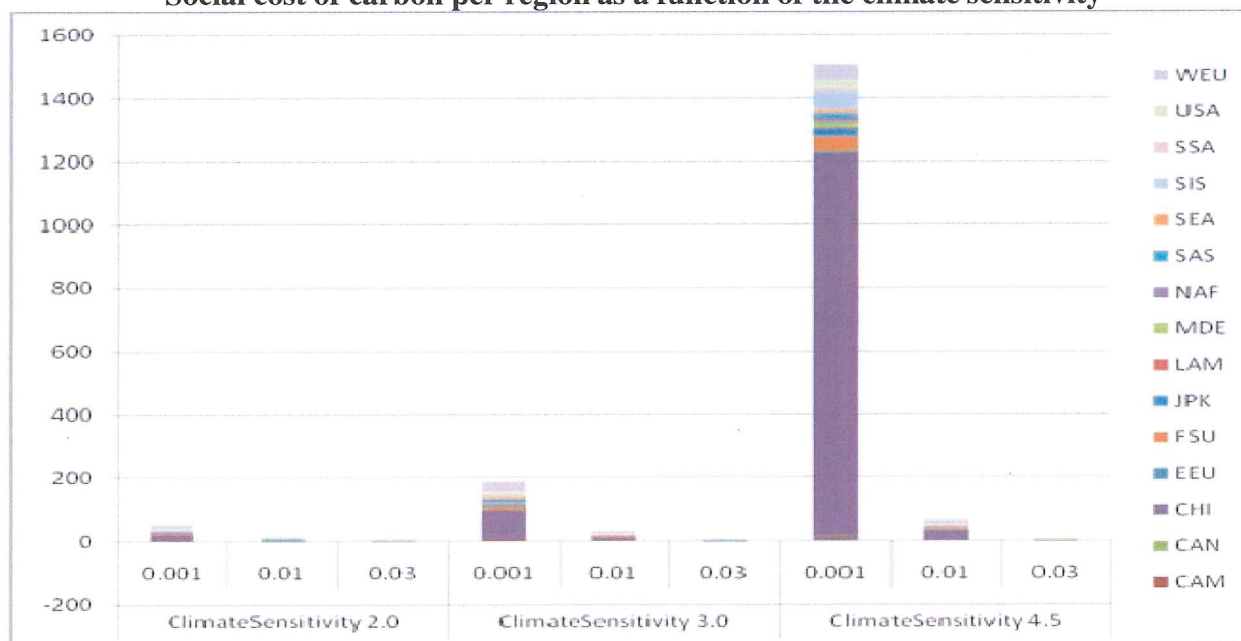
Nordhaus, W. and Sztorc, P. Introduction and User’s Manual, 2<sup>nd</sup> Edition, October 2013,

The 2013 Working Group has not provided the basic assumptions, methods, and underlying data to support the cost/benefit analysis.

### **United States Focus**

The DICE and FUND models established the SCC from a global perspective. We assume the PAGE model also assesses global impact in contrast to the OMB guidance limiting cost/benefit analysis to citizens and residents of the United States. We expect the SCC to be significantly smaller had the guidance been followed. FUND 3.5 showed only a small fraction of the SCC due to projected damages occurring in the United States.<sup>6</sup>

**Social cost of carbon per region as a function of the climate sensitivity**



### **Uncertainty Analysis**

OMB guidance calls for the qualitative disclosure of the main uncertainties in each important input to the calculation of benefits and costs and suggests the inclusion of central tendency estimates (e.g., mean and median) along with ranges, variances, specified low-end and high-end percentile

<sup>6</sup> Anthoff, D, S. Rose, R.S.J. Tol and S. Waldhoff (2011). Regional and sectoral estimates of the social cost of carbon: An application of FUND. ESRI Working Paper 375.

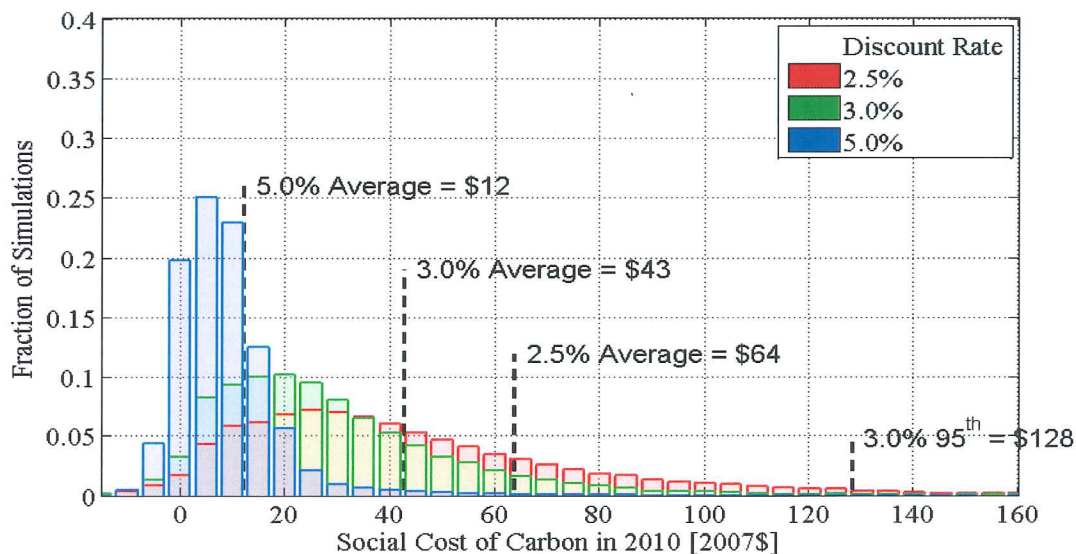
estimates, and other characteristics of the distribution. Each assessment model includes numerous assumptions. The DICE2013-R user manual states:

*“[P]roviding reliable estimates of the damages from climate change over the long run has proven extremely difficult.”*

The manual goes on to detail many the assumptions used to develop the model, a few of which include:

- A climate sensitivity of 2.9 °C for an equilibrium CO<sub>2</sub> doubling.
- Economic and climate policies are designed to optimize the flow of consumption over time.
- The growth rate declines so that total world population approaches a limit of 10.5 billion in 2100 with an initial growth rate of population of 13.4% per period (5 years) is set so that population equals the UN projection for 2050.
- Growth in consumption per capita of 1.9% per year from 2010 to 2100 and 0.9% per year from 2100 to 2200.
- Population growth and technological change are region-specific and exogenous, while capital accumulation is determined by optimizing the flow of consumption over time for each region.
- Substitution from carbon to non-carbon fuels takes place over time as carbon-based fuels become more expensive, either because of resource exhaustion or because policies are taken to limit carbon emissions.

The developers disclosed that the DICE2013-R model adds 25 percent of the monetized damages to SCC to account for non-monetized impacts. Without access to the DICE2010 documentation, we are left to assume a similar “adjustment” factor is imbedded in the current SCC. Each educated guess and adjustment adds a level of uncertainty to the SCC. The many assumptions included in SCC projections leads us to question whether even the two significant figures in the SCC estimate are scientifically valid. At a minimum, the SCC should be reported with both the upper and lower bounds of estimate not just the 95<sup>th</sup> percentile value. As the following TSD graph indicates, the lower bound of the SCC is less than zero.



### **Compliance Costs**

The social cost of carbon for the U.S. is a calculation that has the potential to impose billions of dollars of new regulations and seriously impact economic growth. Without access to the models, we were unable to obtain the dollar amount for any specific benefit or damage included in the SCC to discern if the 2013 Working Group considered the economic and social consequences of using a high SCC value to compel the reduction in CO<sub>2</sub> emissions. The cost of fossil fuel replacement technology is expected to be initially high and may lead to increases in energy prices. States are already seeing higher energy prices as a result of various factors some of which are related to renewable energy portfolio standards (REPS). According to the U.S. Energy Information Administration, during the first nine months of 2013, the average retail price of energy for all sectors in the states with REPS mandates was 25 percent higher at 11.5 cents per kilowatt-hour than States without REPS mandates (9.2 cents per kilowatt-hour).<sup>7</sup> DICE2013R model documentation shows that the SCC must reach \$344 per ton (in \$2010) for 100% removal of CO<sub>2</sub> emissions. The negative externalities associated with establishing a SCC to drive CO<sub>2</sub> reduction may actually exceed the costs of damages associated with increase CO<sub>2</sub> emissions if not accounted for in the models.

Furthermore, it appears energy costs comprise much of the SCC. Cooling/heating costs make up two thirds of the SCC in the FUND 3.5 assessment. Higher energy prices will increase cooling costs and drive up the value of the SCC. Therefore, it is essential to subtract the compliance costs of SCC-directed regulations from the value of the SCC to prevent the SCC from being based costs already implicitly included.

This divergence from the OMB guidance may serve to artificially raise the SCC. An artificially high estimate of the SCC would lend a façade behind which climate change policy and new regulations relying on that cost could hide just as an inaccurately low estimate would fail to properly externalize the costs of GHG emissions. In fact, the SCC estimates might have been much lower; perhaps economically neutral or even negative (showing a beneficial effect), had Working Group 2013 (1) run the models at the 7% discount rate; (2) allowed peer review the assessment models, (3) limited the damage impacts to that are projected to occur to a national level, (4) conducted an uncertainty analysis, and/or (5) accounted for the private sector compliance cost – in other words, had the Working Group (2013) complied with OMB guidance.

### ***Updated Science***

Finally, some studies suggest that global temperatures may not be as sensitive to increases in atmospheric CO<sub>2</sub> concentrations as earlier climate models predict. From 1998 through 2012 the global CO<sub>2</sub> levels continued to rise from 369 parts per million (ppm) to 390 ppm. During this same fifteen year period, the global temperature increased considerably less than was projected in models developed by the Intergovernmental Panel on Climate Change (IPCC) in the Fourth Assessment Report (AR4) released in 2007. As Climate researcher Judith Curry pointed out in her testimony before the Senate Committee on Environment and Public Works, climate observations have not followed model predictions.

#### **Prediction (2007)**

*“For the next two decades, a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios.” (AR4 2007)*

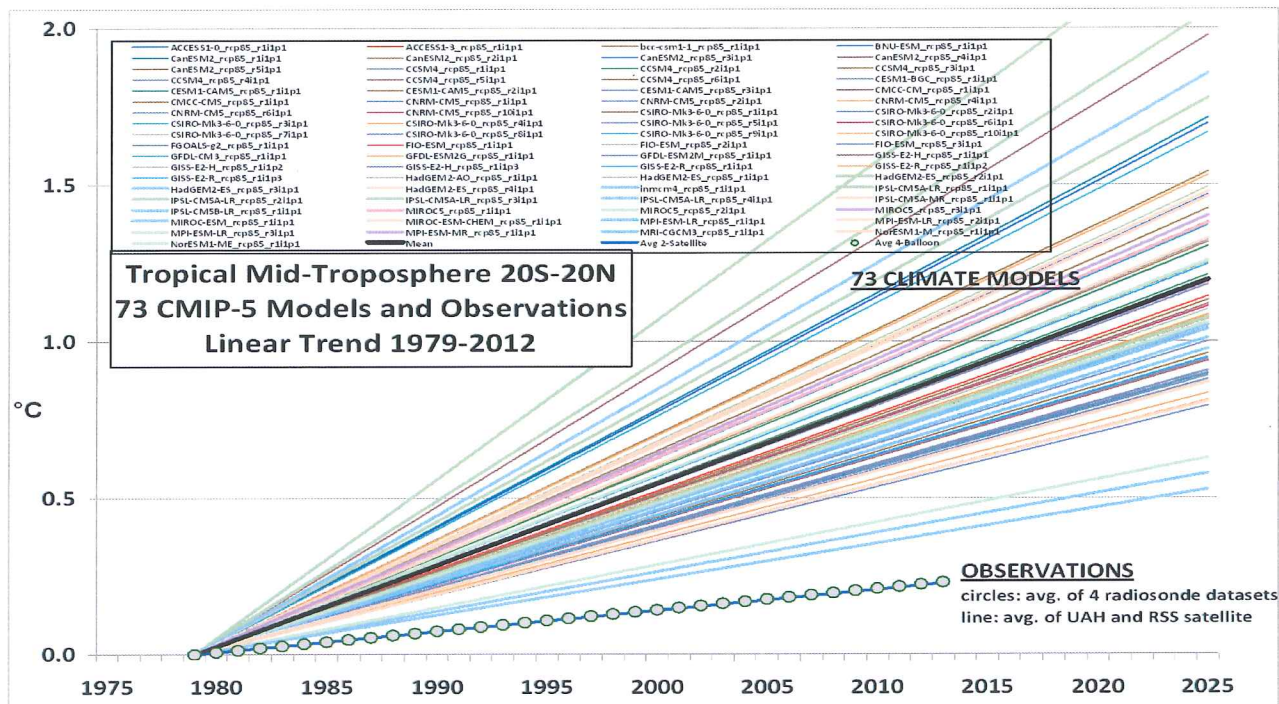
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<sup>7</sup> U.S. Energy Department, Energy Information Administration, November 2013 Report, Table 5.6.B. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector.

## Observation (2012)

“[T]he rate of warming over the past 15 years (1998–2012) [is] 0.05 [–0.05 to +0.15] °C per decade which is smaller than the rate calculated since 1951 (1951–2012) [of] 0.12 [0.08 to 0.14] °C per decade.” (IPCC AR5 Working Group 1 September 2013)

A comparison between the predicted and observed values is given in the following figure.



John Christy, a comparison between 73 CMIP5 models (archived at the KNMI Climate Explorer website) and observations for the tropical bulk tropospheric temperature (aka “MT”) since 1979 (click for large version) <http://www.drroyspencer.com/2013/06/epic-fail-73-climate-models-vs-observations-for-tropical-tropospheric-temperature/>

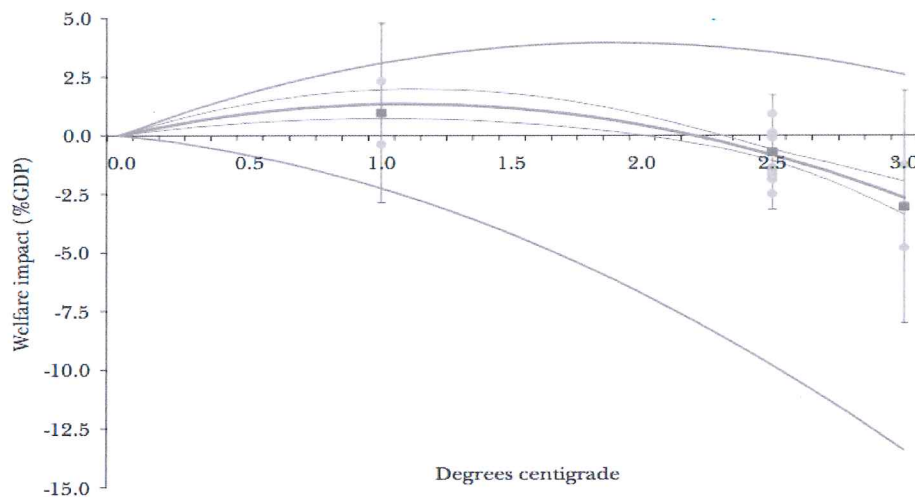
Additional discrepancies between observations and climate model projections include the increasing Antarctic sea ice extent and the absence of increases in severe weather events.<sup>8</sup> Evidence now suggests sea level rise during 1920-1950 is of the same magnitude as in 1993-2012<sup>9</sup>. North Carolina makes no judgment of the validity of these studies. Rather, these studies merely illustrate the uncertainties that may exist in the SCC cost analysis.

<sup>8</sup> Written Testimony of Dr. Roger Pielke, Jr. before the Senate Committee on Environment and Public Works on the Matter of “The Social Cost of Carbon; Some Surprising Facts” July 18, 2013

<sup>9</sup> Written Testimony of Judith A. Curry before the Senate Committee on Environment and Public Works, Hearing on the President’s Climate Action Plan, January 16, 2014.

Due to a lack of transparency we can only assume the assessment models used by the 2013 Working Group relied on out of date climate models which project global temperature to increase 3°C on average for each doubling of the CO<sub>2</sub> concentration in the atmosphere. Observed climate data show the temperature for the past two decades is rising at a rate less than 1°C for each CO<sub>2</sub> doubling. When observed climate sensitivity to CO<sub>2</sub> is considered, most models indicate a net social benefit of carbon (SBC) rather than a cost. The global economic impact of even a 2°C sensitivity is positive as shown below<sup>10</sup>:

**Fourteen Estimates of the Global Economic Impact of Climate Change**



**Climate change as expressed as the welfare equivalent income gain or loss as a function of the global mean temperature relative to today for 14 models including previous versions of the DICE, PAGE, and FUND models**

Among the benefits of higher CO<sub>2</sub> levels is improved general health and increased crop yield.

- Studies have shown the net effect of higher temperatures allegedly brought about by increasing atmospheric concentrations of CO<sub>2</sub> have resulted in a reduction in the rates of sickness and premature death.<sup>11,12</sup>
- Another recent study estimating the direct value of CO<sub>2</sub> enrichment on crop yield was \$140 billion in the year 2011.<sup>13</sup>

Without the release of data, without the adherence to regulatory analysis policy, and without the inclusion of the latest climate change science, North Carolina questions the 2013 Working Group SCC estimates which have increased dramatically from 2010 [averaging \$7, \$26, and \$42 (2007\$) at a 5%, 3%, and 2.5% discount rate] to 2013 [averaging \$12, \$43, and \$64 (2007\$) at a 5%, 3%, and 2.5% discount rate]. The midpoint estimates of the SCC increased by 120 percent with a 5 percent discount rate, 50 percent with a 3 percent discount rate, and 44 percent with a 2.5

<sup>10</sup> Tol, R, 2009 *Journal of Economic Perspectives*

[http://www.econ.yale.edu/~nordhaus/homepage/documents/Tol\\_impacts\\_JEP\\_2009.pdf](http://www.econ.yale.edu/~nordhaus/homepage/documents/Tol_impacts_JEP_2009.pdf)

<sup>11</sup> Christidis, N., Donaldson, G.C, and Stott, P.A. 2010. Causes for the Recent Changes in Cold-and Heat-Related Mortality in England and Wales. *Climate Change* 102: 539-553.

<sup>12</sup> Wichmann J., Anderson, Z.J, Ketzler M., Ellerman, T. and Loft, S. 2011 Apparent Temperature and Cause-Specific Mortality in Copenhagen, Denmark; A Case-Crossover Analysis. *International Journal of Environmental Research and Public Health* 8:3712-3727.

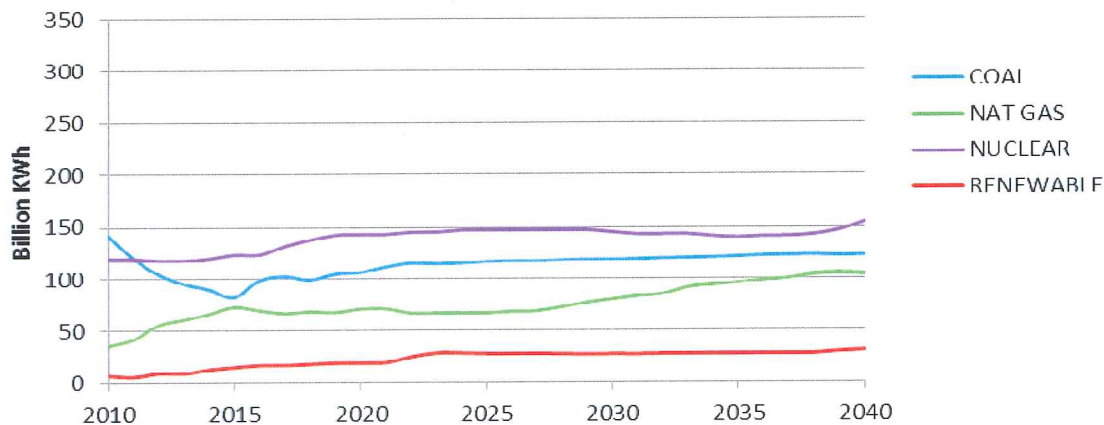
<sup>13</sup> Idso, C. The Positive Externalities of Carbon Dioxide

<http://www.co2science.org/education/reports/co2benefits/MonetaryBenefitsofRisingCO2onGlobalFoodProduction.pdf>

percent discount rate. Simply the recognition of the latest science of climate changes over time, which appears to be in disagreement with observed climate data, makes it difficult to communicate to our constituents the potentially significant economic consequences that will flow from the use of these values of the SCC.

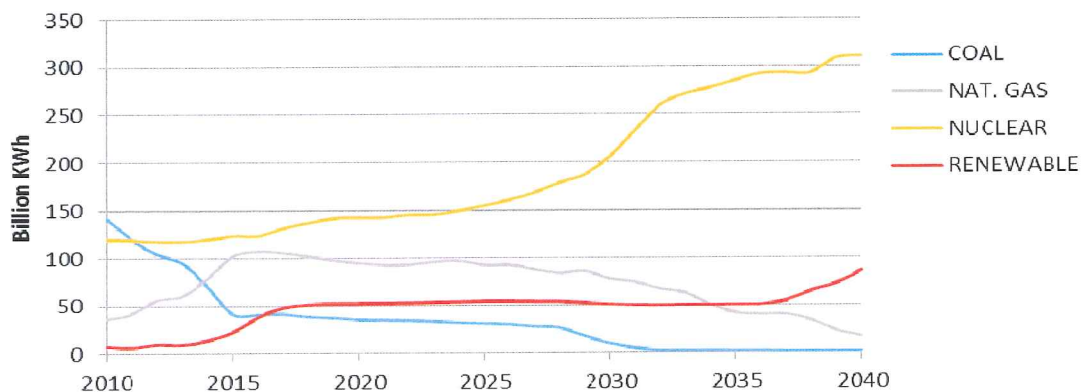
A high SCC value may also constrain the President's "all of the above" energy strategy and our nation's energy security. Rather than allowing a diverse mix of energy options, the projected SCC will drive States to phase out coal and natural gas and depend almost solely on nuclear and renewable energy. (e.g., the recently proposed New Source Performance Standards under the Clean Air Act for new fossil fuel fired electricity generators) In fact, the US EIA forecasts a SCC set at a lower value of \$30 per ton with a 5 percent annual increase will drastically change the way electricity is generated in the Carolinas and Virginia. Within 16 years, the US EIA projects nuclear energy capacity within our three states will more than double and provide two-thirds of all electricity consumed. By 2040, fossil fuels will generate less than 5% of the electricity produced. For comparison, the energy mix is shown using a SCC set near \$0 per ton CO<sub>2</sub>.

### SCC = \$0/ton CO<sub>2</sub>



US Energy Information Administration Annual Energy Outlook 2013

### SCC = \$30/ton CO<sub>2</sub> at 5%



US Energy Information Administration Annual Energy Outlook 2013

Accordingly, North Carolina believes the federal government should take the time to formally consult the States about why recent federal estimates vary so significantly. Given the complexity of the subject, which is reflected by the fact that it took many federal agencies more than five years to produce the document that is under current review, we are perplexed as to why the States have been given a mere 90 days during the holiday season of November, December, and January to provide detailed and thoughtful comments.

The foundation of our country's environmental law is environmental federalism with deference to the States. We ask that you respect that fundamental principle by granting the States access to all relevant information held by the federal government, followed by an extended, rational time period (e.g., 270 days) that would allow the States to review the data and provide informed comments on the social cost of carbon. This request is reasonable, given the fact that our State will be responsible for developing compliance pathways imposed by rules that rely on the SCC.

Sincerely,

A handwritten signature in blue ink, reading "Donald R. van der Vaart". The signature is written in a cursive style with a large, looping initial "D".

Donald R. van der Vaart, Ph.D., P.E., J.D.  
Energy Policy Advisor